

# A METHOD FOR PROVIDING RELIABLE TRANSMISSION QUALITY OF SERVICE IN COMMUNICATION NETWORK

## Field of the Technology

The present disclosure relates to network communication technique field, more particularly to a method for providing reliable transmission quality of service in communication network.

## Background of the Invention

With the development of Internet technology, the networks are of ever increasing scales, various network services emerge and so do advanced multimedia systems. Because real-time services are generally sensitive to network transmission delay, delay jitter and other characteristics, when there is File Transfer Protocol (FTP) service with high burst possibility or Hyper Text Transfer Protocol (HTTP) service with image files, transmission performance of real-time services will be greatly affected; for another, multimedia services in communication networks can occupy large amount of bandwidths, so that key services asking the network for transmission quality may not be transmitted reliably.

Based on the above-mentioned requirement, various techniques providing Quality of Service (QoS) guarantee for service transmission emerge as the times require. To meet the Qos demand of transmission, Internet Engineering Task Force (IETF) has put forward some service models and mechanisms. At present, utilizing Diff-Serv model in core of the network is widely accepted by the industry. Diff-Serv model adopts the measure of setting priority levels to guarantee transmission QoS, although this measure can increase utility rate of bandwidth resource, specific application effect is hard to predict due to lack of corresponding maintenance and management message interaction.

Therefore, an independent bearer control layer is introduced into backbone network Diff-Serv model to manage resources of the bearer network. For instance, to prompt application of Diff-Serv model, in the QoS Backbone (Qbone) experimental

networks driven by IETF and some manufacturers as well as research organizations, bearer network resource managers are used to implement resource and topology management of the bearer network, namely to manage topology resources and coordinate QoS capabilities of Diff-Serve model areas. This kind of Diff-Serve manner that implements said resource management is right the Diff-Serve model with independent bearer control layer.

In a Diff-Serve model with independent bearer control layer, resource management rules and network topology structure of bearer network connection nodes are configured inside bearer network resource manager, and bearer network resource manager takes charge of allocating bandwidth resources on the user's request of service bandwidth application. Request of service bandwidth application and result of the user as well as path information allocated by bearer network resource managers for the service are transferred through signaling between each bearer network resource manager.

When processing the user's request of service bandwidth application, bearer control layer determines path of the user service, and bearer network resource manager notifies edge routers, for example, connection nodes of the bearer network, to transfer the service stream according to the specified path.

To meet the message transmission requirements between bearer network resource managers, Internet2 specifically defines corresponding Bandwidth Broker (BB), Call Agent (CA) or Connection Management (CM) for each Diff-Serve model management domain as bearer network resource managers; the bandwidth broker takes charges in processing the requests of bandwidth application from user hosts or service servers or network maintainers, the bandwidth broker determines whether to permit the user's bandwidth application according to resource reservation status of current network and configuration policy as well as Service Level Agreement (SLA); said call agent acts as a service server which is used to access the user's call to the communication network; said connection manager is used for service layer controlling bearer network layer according to service requirements.

But there are some problems in the above-described Diff-Serv model that is based on bandwidth broker and with independent bearer control layer, for example, Simple Inter-domain Bandwidth Broker Signaling (SIBBS) is adopted between bandwidth brokers to implement the resource request, wherein this signaling is only used between bandwidth brokers and there is no resource synchronization mechanism between bandwidth brokers, namely that resource requests are transmitted through SIBBS directly without the procedure of session establishment or maintenance either without message interaction mechanism used for maintenance and management.

At present, there is no mature technical solution in the industry to transfer request of service bandwidth application and result of the user as well as path information allocated for service request by bearer network resource manager, etc.

### **Summary of the Invention**

Therefore, an object of the present disclosure is to provide a method for providing reliable transmission Quality of Service (QoS) in the communication network, so as to guarantee that effective management upon the whole network resource can be implemented in bearer network and guarantee reliable transmission of important services in the network.

In order to achieve above object, the present disclosure provides a method for providing reliable transmission QoS in the communication network, which includes:

- A. Creating a QoS connection between bearer network resource managers in the communication network;
- B. Exchanging and negotiating the QoS information, which the communication network should provide during the data transmission procedure, among the bearer network resource managers through the QoS connection;
- C. According to the QoS information sent by the bearer network resource manager, the connection node connected to the bearer network resource manager providing corresponding resource.

Wherein, said bearer network resource manager locates in bearer control layer of the communication network.

Wherein, said step A comprising steps for establishing the connection initially:

- A1. Local bearer network resource manager that initiates the create connection procedure sending a establish connection request to peer bearer network resource manager;
- A2. peer bearer network resource manager responding to said creating connection request and creating the QoS-based connection.

Wherein, before step A2 comprising:

Peer bearer network resource manager judging whether identity of local bearer network resource manager is valid, if valid, to said creating connection request and creating the QoS-based connection; otherwise, returning a message of unable to create the connection to local bearer network resource manager.

Wherein, the information carried in the creating connection request comprising: identification and authentication information of the bearer network resource manager initiating the creating connection request.

Wherein, after said step A2 further comprising:

A3. Local bearer network resource manager periodically sending handshake message to peer bearer network resource manager, and determining the connection status according to the handshake response returned by peer bearer network resource manager.

Wherein, said step A3 comprising:

A31. Creating local Keep Active (KA) timer at local bearer network resource manager, and creating peer Keep Active (KA) time at peer bearer network resource manager;

A32. When local KA timer is timeout, local bearer network resource manager adding 1 to timeout times of local KA timer and sending a handshake message to peer bearer network resource manager;

A33. After receiving the handshake message, peer bearer network resource manager restarting peer KA timer and returning a handshake response to local bearer network resource manager;

A34. Local bearer network resource manager determining the created QoS connection status according to timeout times of the local KA timer, peer bearer network resource manager determining the QoS connection status according to whether peer KA timer is timeout.

Wherein, the information carried in said handshake message including:  
Connection ID and connection resource state information.

Wherein, said step B further comprising:

Local bearer network resource manager interacting with peer bearer network resource manager through a plurality of intermediate bearer network resource managers, and said intermediate bearer network resource manager only taking charge in message transfer.

Wherein, after said step B further comprising:

The bearer network resource manager that finally receives said QoS information managing and controlling resources of the connection node under its control according to the received QoS information.

Wherein, the said step B comprising:

B1. Local bearer network resource manager sending QoS resource control message that carries the QoS information to the connection nodes under its control as well as to peer bearer network resource manager;

B2. peer bearer network resource manager sending QoS resource control policy to said connection node according to the received QoS resource control message;

B3. After receiving said QoS resource control policy, the connection node returning a response of QoS resource control policy to the said peer bearer network resource manager;

B4. Peer bearer network resource manager returning a response of the QoS resource control message to local bearer network resource manager.

Wherein, said QoS resource control message in step B1 being:

QoS resource request information, which carries information like connection identification, stream information, QoS parameters and stream descriptor.

Wherein, the said QoS resource control message in step B1 being:  
QoS resource release request, which carries information like connection identifier and reason code.

Wherein, said QoS resource control message in step B1 being:  
QoS resource modify request, which carries information like connection identifier and the modified parameter information corresponding to the QoS resource connection.

Wherein, said QoS resource control message in step B1 being a connection status inquiry message, and said step B4 comprising:

After receiving the response from the connection node, peer bearer network resource manager checking resource consistency of the created QoS connection; and returning a response of the connection status inquiry message to local bearer network resource manager according to the check result.

Wherein, the information carried in said response of connection status inquiry message including:

Connection identifier, or stream information, or QoS parameters, or stream descriptor, or label stack, or path maximum transmission unit, or bearer network resource manager stack, or any combination of the above elements.

Wherein, said message further carrying information like: data consistency information.

Wherein, said data consistency information comprising: parameter global path maximum transmission unit, global label stack depth, intra-domain label stack depth and stream description.

Wherein, said connection node being a router.

Wherein, said bearer network resource manager being a bandwidth broker, or being a call agent, or being a connection manager.

It can be seen from above-described technical scheme that, QoS connections are established between bearer network resource managers in control layer of the bearer network, and the established QoS connections are maintained and managed, wherein online QoS connections can bear various QoS resource control messages and transfer the messages among bearer network resource managers of bearer network control layer, so as to transfer bandwidth request and result of the service as well as path information allocated for the service request and so on. The method for establishing QoS connections between bearer network resource managers provided by the present disclosure are easy to implement, and said QoS connections are easy to maintain and control.

The present disclosure also implements resource synchronization mechanism and operation maintenance mechanism between bearer network resource managers, overcoming the disadvantage of utilizing SIBBS signaling to implement resource request in the prior art that resource synchronization mechanism cannot be implemented between bandwidth brokers. In addition, the present disclosure also implements resource requests transfer and status report transfer between local bearer network resource manager and peer bearer network resource manager, so that performance of the established QoS connections are improved. Therefore, the present disclosure makes it convenient to uniformly manage resources of bearer network and provides technical support to guarantee reliable transmission of important services in the network.

#### **Brief Description of the Drawings**

Figure 1a is a schematic diagram illustrating network structure of communication network according to an embodiment of the present disclosure;

Figure 1b is a schematic diagram illustrating network structure of bearer network resource manager of communication network according to an embodiment of the present disclosure;

Figure 2 is flowchart illustrating the procedure of establishing connections according to an embodiment of the present disclosure;

Figure 3 is a flowchart illustrating the procedure of transferring Quality of Service (QoS) resource control messages according to an embodiment of the present disclosure;

Figure 4 is a flowchart illustrating the procedure of allocating QoS resources according to an embodiment of the present disclosure;

Figure 5 is a flowchart illustrating the procedure of releasing QoS resources according to an embodiment of the present disclosure;

Figure 6 is a flowchart illustrating the procedure of modifying QoS resources according to an embodiment of the present disclosure;

Figure 7 is a flowchart illustrating the procedure of inquiring QoS connection status according to an embodiment of the present disclosure.

### **Embodiments of the Invention**

The present disclosure will be illustrated hereinafter with reference to the embodiment and the accompanying drawings.

Two problems are resolved in the present disclosure, one problem is Quality of Service (QoS) connections cannot be established between CMs or between CA and CM through signaling, and the other problem is that there is no resource synchronization mechanism between Bandwidth Brokers (BB) because SIBBS is adopted to implement resource requests in the conventional art.

Key point of the method of the present disclosure for providing reliable transmission QoS in communication networks is: reliable transmission of QoS resource control messages between bearer network resource managers is implemented in communication networks, and each bearer network resource manager provides requested QoS for corresponding services by taking use of the QoS resource control

messages, so that corresponding transmission QoS can be reliably provided according to transmission request of the service. First of all, a QoS connection between bearer network resource managers is created in the present disclosure, and the QoS connection(s) is(are) used to transfer QoS resource control messages. In addition, resource request and status report between bearer network resource managers are also implemented in the present disclosure, which further enhances the reliability of providing corresponding transmission QoS in communication networks.

In this way, the present disclosure realizes QoS resource control message transfer between entities including BB, CA and CM, and the transfer procedure includes the whole processing procedures such as establishing the connection and maintaining the connection, it can be deemed that the present disclosure is implemented based on Connection Initialization Protocol (RCIP), and the specific processing procedure of implementing the present disclosure based on RCIP will be described in detail hereinafter with reference to the following description.

Now specific embodiment of the present disclosure will be further illustrated hereinafter with reference to the accompanying drawings, as shown in figure 1a, figure 1b and figure 2, the procedure of establishing a QoS connection between bearer network resource managers (CM) includes the following steps:

Step 21: when it is determined that resources of the bearer network need to be controlled and managed through bearer network resource managers located in the bearer control layer, an initial local bearer network resource manager will send an Establish Connection Request to an initial peer bearer network resource manager, for instance, an “OPEN” message may be sent as an Establish Connection Request requesting to create a QoS connection between the local bearer network resource manager and the peer bearer network resource manager.

Said Establish Connection Request carries information like: identifier and authentication information of the bearer network resource manager requesting to establish the connection, so that the peer bearer network resource manager can authenticate whether to establish the connection according to said authentication information.

Besides, said Establish Connection Request also optionally includes data consistency information, and said data consistency information is used to guarantee that the message is not distorted during the transmission and to avoid invasion of illegal messages, thereby data consistency message generally includes 32bits KEY\_ID, 32bits serial number and 96bits abstract, wherein, the KEY\_ID is used to identify key value and algorithms shared by both parties, the serial number is initialized when “OPEN” message is transmitted, added orderly when subsequent messages are transmitted, and restarted from 0 when an overflow occurs to avoid invasion by illegal messages.

Said local bearer network resource manager is generally configured with management rules required for managing bearer network resources and network topology information of bearer network, which can implement corresponding resource control management functions, like completing resource allocation of corresponding bandwidth request, allocating corresponding path information for service requests in the network and so on.

Bearer network control layer generally comprises one or more bearer network resource manager, like a local bearer network resource manager, a plurality of intermediate bearer network resource managers and a peer bearer network resource manager shown in figure 1b, said local bearer network resource manager, intermediate bearer network resource manager and peer bearer network resource manager are all in allusion to a specific QoS connection, wherein the initial point of a QoS connection is regarded as a local bearer network resource manager, the terminal point of a QoS connection is regarded as a peer bearer network resource manager, while those bearer network resource managers through which the messages are transmitted from a local bearer network resource manager to a peer bearer network resource manager are called intermediate bearer network resource managers. In communication networks, said local bearer network resource manager generally needs to transmit the corresponding message to a peer bearer network resource manager through a plurality of bearer network resource managers, namely that a QoS resource control message has to pass a path from a local bearer network resource manager through a plurality of bearer network resource managers before arriving at a peer bearer network resource

manager, and finally resource control management on corresponding connection nodes is implemented by the peer bearer network resource manager, wherein said connection nodes are usually routers.

Step 22: after receiving the “OPEN” message from a local bearer network resource manager, according to the received authentication information and identity identifier, the peer bearer network resource manager checks validity of identity of the local bearer network resource manager that has sent the connection request, if identity of the local bearer network resource manager is valid, the peer bearer network resource manager will send an Establish Connection Response to the local bearer network resource manager, wherein the Establish Connection Response carries relevant information for establishing the QoS connection, for example, the peer bearer network resource manager may send an “ACCEPT” message to the local bearer network resource manager as the Establish Connection Response and the “ACCEPT” message carries time-over time span of local Keep Active (KA) timer; if identity of the local bearer network resource manager is invalid, the peer bearer network resource manager will send a message indicating inability of establishing corresponding connection to the local bearer network resource manager, wherein the message carries corresponding reason code that is used to indicate the reason that the connection cannot be established.

While sending the “ACCEPT” message, the peer bearer network resource manager also need to initiate the peer KA timer and be in Online state, namely the QoS connection between the peer bearer network resource manager and the local bearer network resource manager is established.

After receiving the “ACCEPT” message sent by the peer bearer network resource manager, the local bearer network resource manager will initiate local KA timer and enters Online state, namely the QoS connection between the peer bearer network resource manager and the local bearer network resource manager is established; if receiving a message unable to establish corresponding connection sent by the peer bearer network resource manager, the local bearer network resource manager can resend an Establish Connection Request to the peer bearer network resource manager according to specific requirements.

So far, the QoS connection between the local bearer network resource manager and the peer bearer network resource manager in the bearer network control layer, while step 23 and step 24 represent the control procedure of maintaining the established QoS connection.

Step 23: the timer of local KA will be restarted when the timer of local KA time-over, and the local bearer network resource manager adds 1 to overtime times of the local KA timer so as to calculate overtime times of the local KA timer, and meanwhile needs to send a KA message, i.e. a handshake message, to peer bearer network resource manager in order to monitor whether the peer bearer network resource manager is in normal connection state.

Step 24: if in normal connection state, after receiving the KA message, the peer bearer network resource manager will send a KA message to the local bearer network resource manager as the handshake response sent by the local bearer network resource manager, restart the peer KA timer and maintain the Online state of the QoS connection. After receiving the KA message sent by the peer bearer network resource manager, the local bearer network resource manager will clear overtime times of the local KA timer as zero and maintain the Online state of the QoS connection.

If the local bearer network resource manager does not receive the KA message returned by the peer bearer network resource manager all along, overtime times of the local KA timer will exceed the allowable value, and the local bearer network resource manager will release the established QoS connection; in the same way, if the peer bearer network resource manager des not receive the KA message returned by the local bearer network resource manager all along, the peer KA timer is time-out, and the peer bearer network resource manager will release the established QoS connection; this added QoS connection maintenance mechanism can effectively guarantee that network resource is reasonably occupied by the established QoS connection.

After the QoS connection is established, specific QoS resource control messages may be transferred between the local bearer network resource manager and the peer bearer network resource manager in the bearer network layer of the communication

network, so as to control and manage resources of the connection nodes that belong to bearer network resource manager.

A QoS connection in Online state is established after the processing procedure of step 21 to step 24, wherein the QoS connection can bear various kinds of QoS resource control messages, while the said QoS resource control messages bear the QoS information for transmitting a certain service in the communication network, and for example, the required QoS information includes the requested bandwidth for a certain service, allowed stream and so on, the specific embodiment of the method of the present disclosure will be further illustrated hereinafter with reference to figure 3:

Step 31: the requested QoS information for control management upon the resources between two connection nodes in the bearer network, namely QoS parameters and other information, is determined, a local bearer network resource manager sends a QoS resource control message to a peer bearer network resource manager, wherein the QoS resource control message bears the determined QoS information for the peer bearer network resource manager to perform resource control management upon corresponding connection nodes.

Meanwhile, the local bearer network resource manager also transmits the determined QoS information to the connection nodes managed by the local bearer network resource manager, wherein the connection nodes perform resource control management in terms of the service according to the said QoS information.

In a communication network, some important services usually request for the transmission services with high priorities or transmitting some services according to specified bandwidth, etc, therefore, resources of corresponding connection nodes in the bearer network need to be controlled and managed according to specific demands, so as to meet the transmission requirement of corresponding service, namely to control and manage the resources between the start connection node and terminal connection node of the said service.

QoS information of a communication network is generally transmitted to a bearer network resource manager of the bearer control layer by the service control layer in the network, and then is transferred among the bearer network resource managers.

Step 32: after receiving the QoS resource control message sent by the local bearer network resource manager, the peer bearer network resource manager will send a QoS control policy, which is determined according to the QoS resource control message, to the connection node, the QoS control policy includes QoS policy install command and relevant information.

Step 33: after receiving the said QoS control policy, the connection nodes of the peer bearer network resource manager will perform corresponding resource control and management operation, and send a response message in allusion to the said QoS control policy to the said peer bearer network resource manager.

Step 34: after receiving the response in allusion to the said QoS control policy sent by the connection node controled by the peer bearer network resource manager and relevant information, the peer bearer network resource manager will send a QoS resource control response to the local bearer network resource manager, so that the local bearer network resource manager can accurately get to know whether the corresponding QoS resource control message is reliably received, and whether corresponding resource control management operation is performed at corresponding connection node.

After the processing procedure of step 31 to step 34, needed QoS resource control messages can be transferred between two connection nodes concerned with a certain specific transmission service in the bearer network.

In order to transfer QoS resource control messages between a local bearer network resource manager and a peer bearer network resource manager, QoS resource need to be requested to allocate, as shown in figure 4, the procedure of processing QoS resource request is as follows:

Step 41: when receiving the to-be-transmitted QoS information sent by service control layer, the local bearer network resource manager needs to initiate a QoS resource request to the peer bearer network resource manager at first, namely to send a QoS resource request to the peer bearer network resource manager, and then step 42 is executed.

Information carried by the said QoS resource request includes:

If the QoS resource request is sent to CM by CA, it comprises: connection Identifier (ID), stream information, QoS parameter, flow descriptor, and it can comprise data consistency information optionally;

If the QoS resource request is bilateral and transferred between CMs, it comprises: connection ID, stream information, QoS parameter, flow descriptor, Label Switching Path (LSP) connection information, and it may further comprise data consistency information optionally;

If the QoS resource request is unilateral and transferred between CMs, it comprises: connection ID, stream information, QoS parameter, flow descriptor, LSP connection information, and it may further comprise data consistency information optionally.

Step 42: after receiving the QoS resource request sent by the local bearer network resource manager, the peer bearer network resource manager will perform service routing and resource allocation, and send QoS resource request to the connection nodes that belong to the peer bearer network resource manager, namely sending stream mapping install command to the connection node.

If the messages need to be transferred from the local bearer network resource manager to the peer bearer network resource manager through a plurality of intermediate bearer network resource managers, the local bearer network resource manager sends the QoS resource request to the next hop intermediate bearer network resource manager first of all, the said intermediate bearer network resource manager performs routing and resource allocation, returns a response towards the QoS resource

request to the previous hop intermediate bearer network resource manager or the local bearer network resource manager after the resource request is successful and continues to forward the said QoS resource request, until the peer bearer network resource manager receives this QoS resource request, and then the said operation in step 43 is executed.

Step 43: after receiving the stream mapping install command, the connection node will perform corresponding stream mapping install process, and send a response message of the stream mapping install command to the peer bearer network resource manager.

Step 44: after receiving the response message of the stream mapping install command sent by the connection node, the peer bearer network resource manager will send a response message of accepting the QoS resource request or rejecting the QoS resource request to the local bearer network resource manager.

Information carried by the said QoS resource response includes:

If the response of accepting the QoS resource request is sent to CM by CA, it comprises: connection Identifier (ID), stream information, QoS parameter, flow descriptor, and it can further comprise data consistency information optionally;

If the response of rejecting the QoS resource request is sent to CM by CA, it comprises: connection Identifier (ID) and reason code and it can further comprise data consistency information optionally;

If the response of accepting the QoS resource request is bilateral and sent to CM by CM, it comprises: connection Identifier (ID), stream information, QoS parameter, flow descriptor, LSP information, and it can further comprise data consistency information optionally;

If the response of accepting the QoS resource request is unilateral and sent to CM by CM, it comprises: connection Identifier (ID), stream information, QoS

parameter, flow descriptor, LSP information, and it can further comprise data consistency information optionally;

If the response of rejecting the QoS resource request is sent to CM by CM, it comprises: connection Identifier (ID), reason code, and data consistency information optionally.

After the said QoS resources are bore and allocated between the local bearer network resource manager and the peer bearer network resource manager, when the message transfer procedure ends or the message transfer cannot be normally performed and the procedure has to be ended due to exceptions in the communication network, the process of releasing the QoS resources has to be performed, and the specific processing procedure is shown in figure 5, comprising the following steps:

Step 51: when a service communication procedure is ended or the communication cannot be normally performed due to exceptions, the local bearer network resource manager needs to send a QoS resource release request to the peer bearer network resource manager so as to release the QoS resource allocated for it, meanwhile, the local bearer network resource manager also has to send stream mapping delete command to the connection nodes connected to and managed by the local bearer network resource manager, and the connection nodes perform corresponding stream mapping delete operation according to the received stream mapping delete demand.

The said QoS resource release request carries information including:

If the QoS resource release request message is transferred between CA and CM, it comprises: connection Identifier (ID) and reason code, and it may also comprises data consistency information optionally;

If the QoS resource release request message is transferred between CM and CM, it comprises: connection Identifier (ID) and reason code, and it may also comprises data consistency information optionally.

Step 52: after receiving the QoS resource release request sent by the local bearer network resource manager, the peer bearer network resource manager finishes releasing the QoS resource and meanwhile sends delete QoS control policy command, i.e. stream mapping delete command, to the connection nodes connected to and managed by peer bearer network resource manager, and then step 53 is executed.

Step 53: the connection nodes receive the steam mapping delete command sent by the peer bearer network resource manager, and send stream mapping delete command response to the peer bearer network resource manager after finishing corresponding stream mapping delete operation.

Step 54: after receiving the stream mapping delete command response sent by affiliated connection nodes, the peer bearer network resource manager sends a QoS resource release response message to the local bearer network resource manager.

After the said QoS resources are bore and allocated between the local bearer network resource manager and the peer bearer network resource manager, the allocated QoS resources may needs modifying according to practical demand of message transfer procedure, like adjusting the allocated bandwidth resources and allowed maximum stream and so on, wherein specific processing procedure of modifying the QoS resources is shown in figure 6, comprising the following steps:

Step 61: when it is needed to modify the allocated QoS resources, the local bearer network resource manager sends a QoS resource modify request to the peer bearer network resource manager, wherein the QoS resource modify request carries the to-be-modified QoS resource identifier and the modified QoS resource information and so on, meanwhile the local bearer network resource manager needs to send QoS resource modify message, namely stream mapping update message, to the connection nodes under its control and management, wherein the said connection nodes performs corresponding stream mapping update operations according to the received stream mapping update command, so that the QoS resource are modified.

Step 62: after receiving the QoS resource modify request sent by the local bearer network resource manager, the peer bearer network resource manager sends stream

mapping update command to the connection nodes under its control and management according to the information carried in the QoS resource modify request.

If the QoS resource modify request of the local bearer network resource manager has to pass a plurality of intermediate bearer network resource managers before arriving at the peer bearer network resource manager, each intermediate bearer network resource manager receiving the QoS resource modify request will forward the QoS resource modify request to the next intermediate bearer network resource manager, until the peer bearer network resource manager receives the QoS resource modify request, and then step 62 will be executed.

The said QoS resource modify request carries information including: parameter global Path Maximum Transmission Unit (PATH MTU), global label stack depth, intra-domain label stack depth, stream descriptor and so on.

Step 63: after receiving the stream mapping update command sent by the peer bearer network resource manager and performing corresponding steam mapping update operation, the connection nodes will send stream mapping update command response message to the peer bearer network resource manager.

Step 64: after receiving the stream mapping update command response message sent by the connection node, the peer bearer network resource manager learns that QoS resource modification is successful and will send a QoS resource modify response to the local bearer network resource manager.

To guarantee connection status consistency of both ends of the established QoS connection, namely to guarantee synchronization of resources on both ends of the QoS connection, thereby to implement reliable transfer of QoS resource control messages, the said method of the present disclosure further comprises a processing procedure of checking the status of the QoS connection established between local bearer network resource manager and peer bearer network resource manager, wherein the specific procedure of checking the QoS connection status is shown in figure 7, comprising the following steps:

Step 71: the local bearer network resource manager sends a connection status inquiry request to the peer bearer network resource manager periodically or according to settled condition, wherein the connection status inquiry request carries connection status information of the local bearer network resource manager, meanwhile, the local bearer network resource manager sends connection status inquiry request to the connection nodes under its control and management, and the corresponding connection node will return QoS connection resource status to the local bearer network resource manager after receiving the connection status inquiry request, and then local bearer network resource manager checks QoS resource consistency according to the connection resource status sent by the connection node.

Step 72: after receiving the connection status inquiry request sent by the local bearer network resource manager, the peer bearer network resource manager will initiate connection status inquiry to the connection node under its control and management, namely that peer bearer network resource manager will send connection status inquiry message to the connection node.

Step 73: after receiving the connection status inquiry request, the said connection node will send a connection status inquiry response to the peer bearer network resource manager, namely that the connection node will return QoS connection resource status of the connection node to the peer bearer network resource manager.

Step 74: the peer bearer network resource manager checks the QoS resource consistency according to the QoS connection resource status returned by the connection node, and returns a connection status inquiry request to the local bearer network resource manager, namely that peer bearer network resource manager returns a connection status inquiry report to the local bearer network resource manager.

If the interaction between the peer bearer network resource manager and the local bearer network resource manager has to pass one or more intermediate bearer network resource managers, the intermediate bearer network resource manager need to return a connection status inquiry report to the previous bearer network resource manager after receiving the connection status inquiry request.

The said connection status inquiry report carries information includes:

If CM sends the connection status inquiry report to CA, the connection status inquiry report comprises: connection ID, connection resource status, and it can further comprise data consistency information optionally;

If CM sends the connection status inquiry report to CM, the connection status inquiry report comprises: connection ID, connection resource status, and it can further comprise data consistency information optionally.

In the present disclosure, when the messages need to be transferred from a local bearer network resource manager to a peer bearer network resource manager through one or more intermediate bearer network resource managers, the said intermediate bearer network resource managers only play the message transfer role, without needing to send corresponding messages to the connection nodes under its control and management just as the local bearer network resource manager and the peer bearer network resource manager do.

In a word, the above-description is just a preferable embodiment of the present disclosure, not used to confine the protection scope of the present disclosure.

## Claims

1. A method for providing reliable transmission Quality of Service (QoS) of service in communication network, the method comprising:
  - A. Creating a QoS connection between bearer network resource managers in the communication network;
  - B. Exchanging and negotiating the QoS information, which the communication network should provide during the data transmission procedure, among the bearer network resource managers through the said QoS connection;
  - C. According to the QoS information sent by the bearer network resource manager, the connection node connected to the bearer network resource manager providing corresponding resource.
2. The method according to claim 1, wherein, said bearer network resource manager locates in bearer control layer of the communication network.
3. The method according to claim 1, wherein, said step A comprising steps for establishing the connection initially:
  - A1. Local bearer network resource manager that initiates the create connection procedure sending a establish connection request to peer bearer network resource manager;
  - A2. Peer bearer network resource manager responding to said creating connection request and creating the QoS-based connection.
4. The method according to claim 3, wherein, before step A2 comprising:

Peer bearer network resource manager judging whether identity of local bearer network resource manager is valid, if valid, responding to said creating connection request and creating the QoS-based connection; otherwise, returning a message of unable to create the connection to local bearer network resource manager.
5. The method according to claim 3, wherein, the information carried in the creating connection request comprising: identification and authentication information of the bearer network resource manager initiating the creating connection request.

6. The method according to claim 3, wherein, further comprising:

A3. Local bearer network resource manager periodically sending handshake message to peer bearer network resource manager, and determining the connection status according to the handshake response returned by peer bearer network resource manager.

7. The method according to claim 6, wherein, the said step A3 comprising:

A31. Creating local Keep Active (KA) timer at local bearer network resource manager, and creating peer Keep Active (KA) time at peer bearer network resource manager;

A32. When local KA timer is timeout, local bearer network resource manager adding 1 to timeout times of local KA timer and sending a handshake message to peer bearer network resource manager;

A33. After receiving the handshake message, peer bearer network resource manager restarting peer KA timer and returning a handshake response to local bearer network resource manager;

A34. Local bearer network resource manager determining the created QoS connection status according to timeout times of the local KA timer, peer bearer network resource manager determining the QoS connection status according to whether peer KA timer is timeout.

8. The method according to claim 6, wherein, the information carried in the said handshake message including:

connection ID and connection resource state information.

9. The method according to claim 3, wherein, the said step B further comprising:

Local bearer network resource manager interacting with peer bearer network resource manager through a plurality of intermediate bearer network resource managers, and said intermediate bearer network resource manager only taking charge in message transfer.

10. The method according to claim 1 or 2, wherein, the said step B further comprising:

The bearer network resource manager that finally receives said QoS information managing and controlling resources of the connection node under its control according to the received QoS information.

11. The method according to claim 1, wherein, the said step B comprising:

B1. Local bearer network resource manager sending QoS resource control message that carries the QoS information to the connection nodes under its control as well as to peer bearer network resource manager;

B2. Peer bearer network resource manager sending QoS resource control policy to said connection node according to the received QoS resource control message;

B3. After receiving said QoS resource control policy, the connection node returning a response of QoS resource control policy to the said peer bearer network resource manager;

B4. Peer bearer network resource manager returning a response of the QoS resource control message to local bearer network resource manager.

12. The method according to claim 11, wherein, the said QoS resource control message in step B1 being:

QoS resource request information, which carries information like connection identification, stream information, QoS parameters and stream descriptor.

13. The method according to claim 11, wherein, the said QoS resource control message in step B1 being:

QoS resource release request, which carries information like connection identifier and reason code.

14. The method according to claim 11, wherein, said QoS resource control message in step B1 being:

QoS resource modify request, which carries information like connection identifier and the modified parameter information corresponding to the QoS resource connection.

15. The method according to claim 11, wherein, said QoS resource control message in step B1 being a connection status inquiry message, and said step B4 comprising:

After receiving the response from the connection node, peer bearer network resource manager checking resource consistency of the created QoS connection; and returning a response of the connection status inquiry message to local bearer network resource manager according to the check result.

16. The method according to claim 15, wherein, the information carried in said response of connection status inquiry message including:

Connection identifier, or stream information, or QoS parameters, or stream descriptor, or label stack, or path maximum transmission unit, or bearer network resource manager stack, or any combination of the above elements.

17. The method according to claim 5 or claim 8 or claim 12 or claim 13 or claim 14 or claim 16, wherein, said message further carrying information like: data consistency information.

18. The method according to claim 17, wherein, said data consistency information comprising: parameter global path maximum transmission unit, global label stack depth, intra-domain label stack depth and stream description.

19. The method according to claim 11, wherein, said connection node being a router.

20. The method according to claim 1, wherein, said bearer network resource manager being a bandwidth broker, or being a call agent, or being a connection manager.

## Abstract

The present disclosure discloses a method for providing reliable transmission Quality of Service (QoS) in communication network, in this method, a QoS connection is established between bearer network resource managers in bearer network control layer, and maintenance management mechanism is well established in terms of the said QoS connection. Various QoS resource control messages can be carried through this established QoS connection, so that request of service bandwidth application of the user and the result thereof, as well as the path information allocated by bearer network resource managers can be transferred. The method of the present disclosure is reliable and easy to implement and maintain, with good controlled quality, and can implement resource synchronization between bearer network resource managers. Therefore, implementation of the present disclosure makes it more convenient to manage resources of bearer network uniformly, and provides technical support on guaranteeing transmission reliability of important services.

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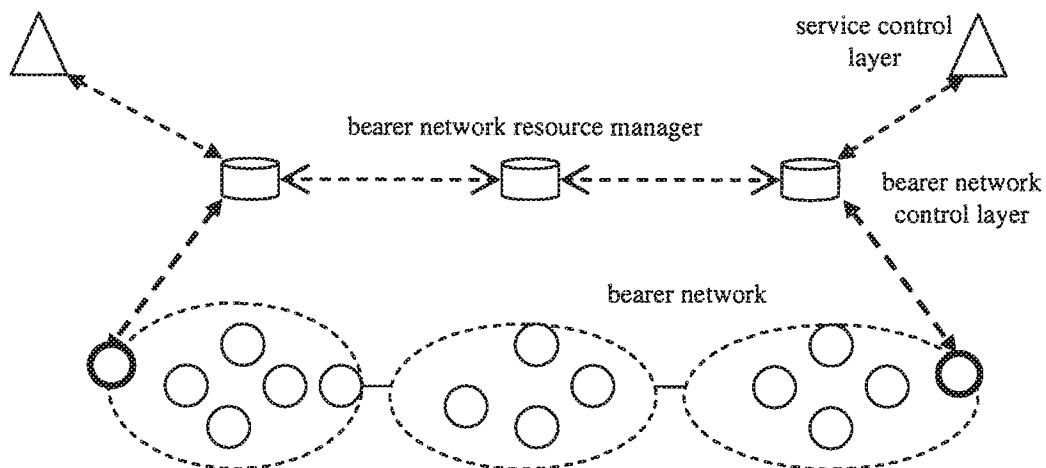


FIG. 1a

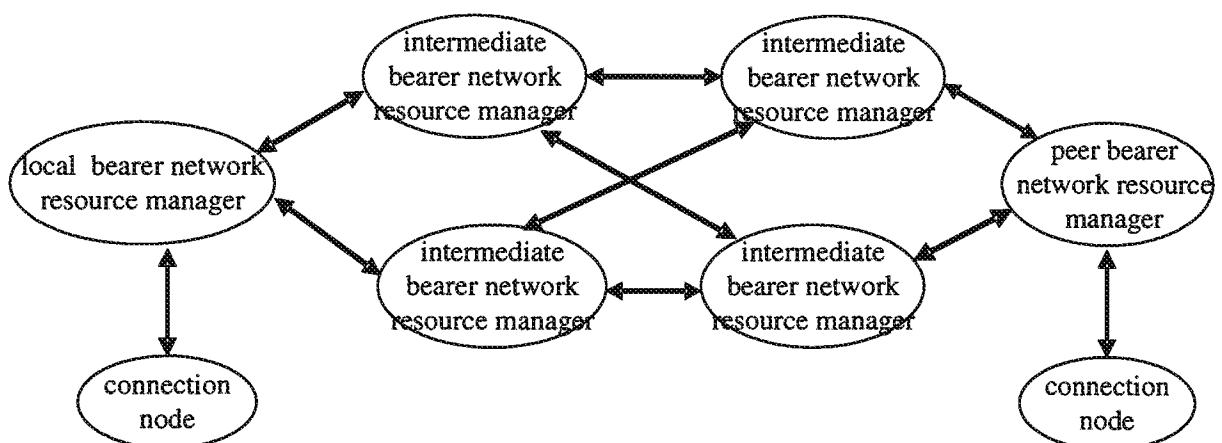


FIG. 1b

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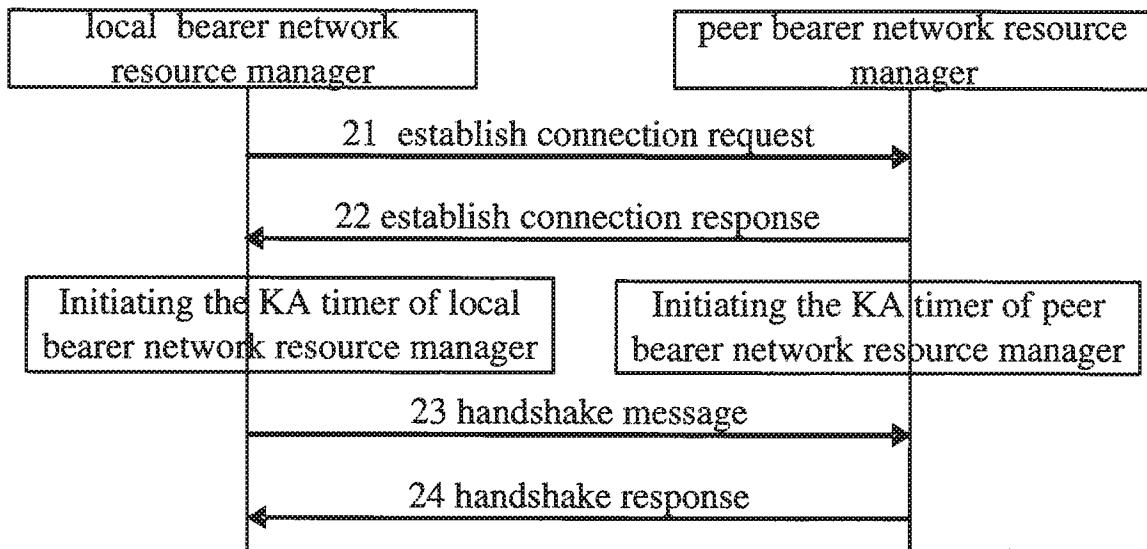


FIG. 2

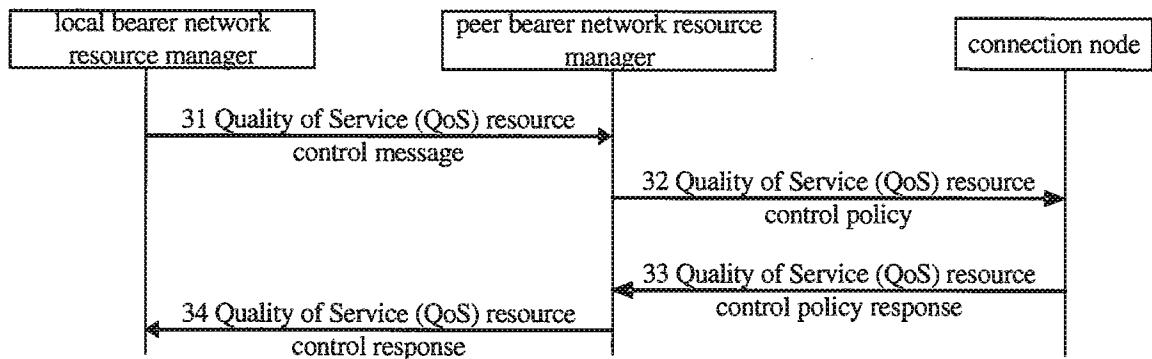


FIG. 3

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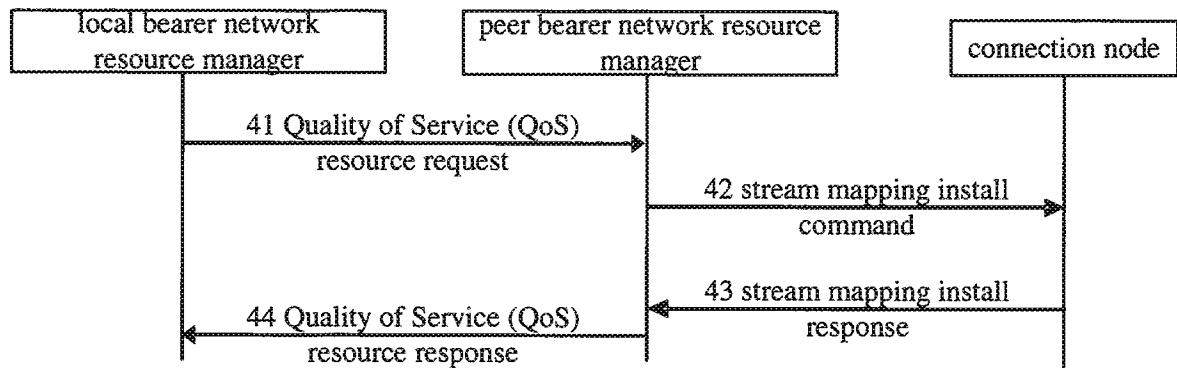


FIG. 4

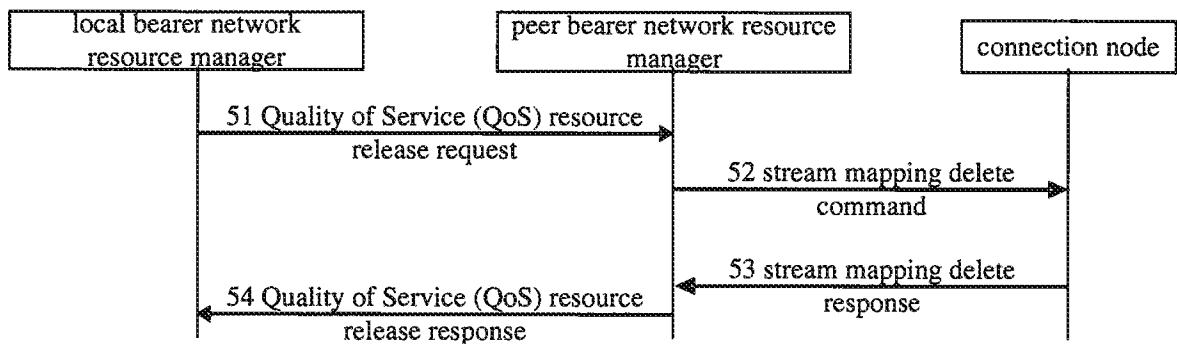


FIG. 5

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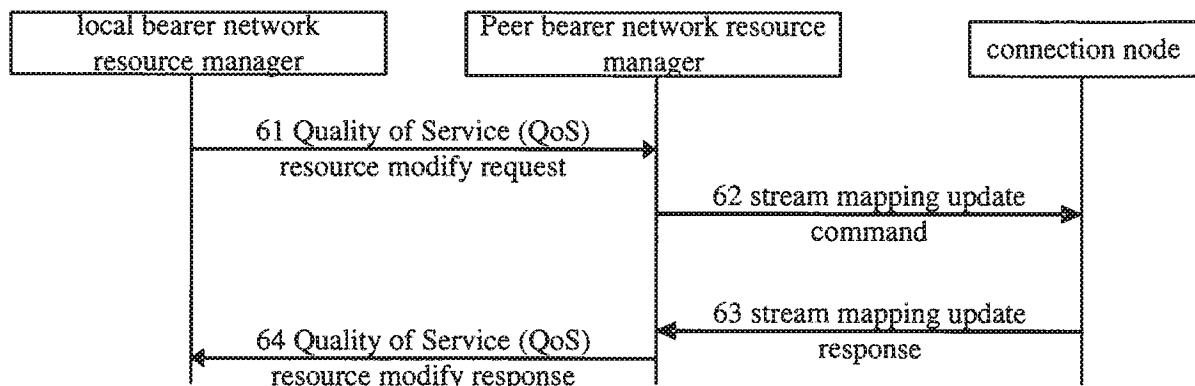


FIG. 6

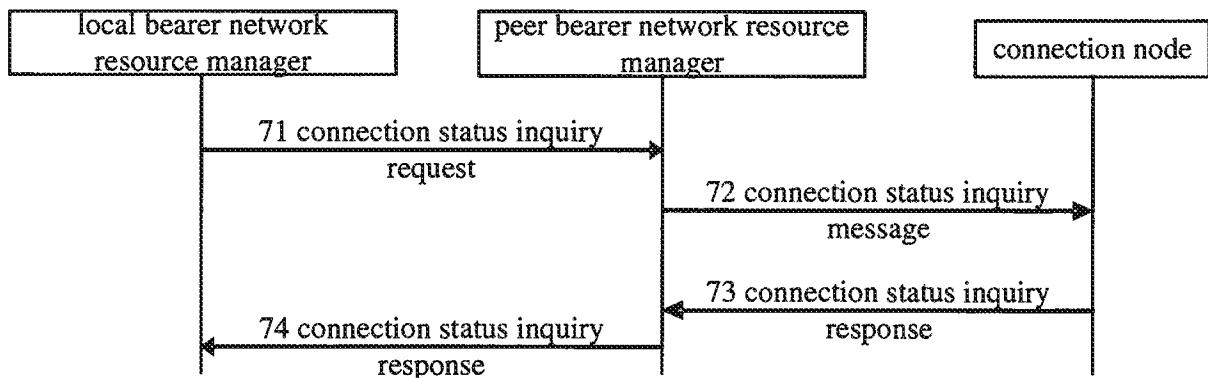


FIG. 7